Laboratory Measurements of Vp, Vs and Vp/Vs for polycrystalline labradorite up to 800˚C and 1GPa

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In order to estimate the elastic properties of crustal rock-forming minerals at mid-to-lower crustal P-T conditions, we performed simultaneous measurements of compressional-wave (Vp) and shear-wave (Vs) velocities of the labradorite. In this presentation, we report temperature-pressure dependence of the elastic wave velocity for labradorite, intermediate member of plagioclase feldspars, at crustal P-T condition.

The fine-grained pollycrystalline labradorite was fabricated from the nano-sized powders of crushed natural labradorite crystal ($An_{61}Ab_{37}Or_2$, $An_{65}Ab_{34}Or_1$), and was used for the measurements. After milling and forming mineral powders, sintering was carried out at a temperature of 1180–1210˚C with controlled time. Ultrasonic measurements on these samples were conducted up to 1.0 GPa in a temperature range of 25-800˚C with a piston cylinder high pressure apparatus.

The Vp increase rapidly with pressure increase up to 0.40 GPa at room temperature, while it is moderately increasing between 0.40 and 1.00 GPa. At 1.00GPa up to 800 ˚C, the elastic wave velocities decrease with increasing temperature blow 600 ˚C, δVp/δT and δVs/δT of the labradorite sample (An65Ab34Or1) is -1.6×10^{-4} km/s/˚C, -1.0×10^{-4}km/s/˚C . In contrast, above 600 ˚C , the elastic wave velocities show an increasing trend in the range of 600–800 ˚C . At cooling stage, Vp and Vs show an decreasing trend with decreasing temperature above 400˚C.
Previous studies report that elastic wave velocities of polycrystalline anorthite show an increasing trend in the range of 240–640 ˚C (Matsukage et al 2015) and that a polycrystalline plagioclase ($An_{51\pm1}$) at 1.0 GPa show marked increase in Vp and Vs between 700 and 800 ˚C (Kono et al 2008). They suggest that these discontinuous velocity changes in temperature dependence of Vp and Vs would be associated with phase transformation in plagioclase. However, it is unclear whether our measurements results between 650 and 800˚C is phase transformation, because the phase transformation was not determined on our sample using X-ray diffraction analisys. In addition, the temperature conditions of the discontinuous in Vp and Vs at high temperature is not consistent with the phase boundary previously reported. Phase transformation, therefore, would have been only temporary during the experiment.

Keywords: elastic wave velocity, polycrystalline labradorite, sintering

